The Seasonal Occurrence of Some Prominent Zooplankton Species in Rough Firth. I. Scyphomedusae

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Six species of scyphomedusae, or larger jellyfish, occur around the British Isles. Four of these are found normally in Rough Firth, Kirkcudbrightshire, two being especially abundant: *Chrysaora hysoscella* (L.) and *Rhizostoma octopus* (L.). The other two species, *Aurelia aurita* (L.), the common jellyfish, and *Cyanea capillata* (L.), the brown jellyfish, are much less common, the latter entering Rough Firth only rarely. Despite their large size these are truly planktonic animals capable of changing depth and direction but otherwise at the mercy of wind and tide.

The long trailing tentacles of *Chrysaora* and *Cyanea* are used to capture food, the former preferring smaller medusae and arrow worms, the latter fish. In contrast, *Aurelia* and *Rhizostoma* are ciliary feeders. The upper and lower surfaces of the umbrella of *Aurelia* trap small planktonic organisms such as barnacle larvae and copepods in sticky mucus which is driven by cilia to the umbrella margin where the food collects in eight food pouches. The tips of the mouth lobes then pick up the food. Apparently the marginal tentacles play a minor part only in food capture. Unlike any other of our jellyfish the manubrium of *Rhizostoma* bears many thousands of minute openings through which water is continually drawn by cilia. These openings are surrounded by small tentacles bearing nematocysts, so that a huge trapping area is presented to the plankton as the animal swims through the water.

Aurelia provides a typical example of a scyphomedusan life-history (Fig. 1). The free-swimming planula larva, which develops from the fertilised egg, gives rise to a short-stalked primary polyp found attached to mussels, fucoid sea-weeds and other substrata. Ring-like

constrictions develop round the polyp so that it resembles ultimately a pile of saucers, the margins of each becoming eight-lobed. This is the scyphistoma and is about 2-7mm high. Each saucer separates from the scyphistoma, turns upside down and swims off as an ephyra which then grows into the familiar jellyfish.

This paper describes the occurrence of ephyrae and their subsequent development in Rough Firth.

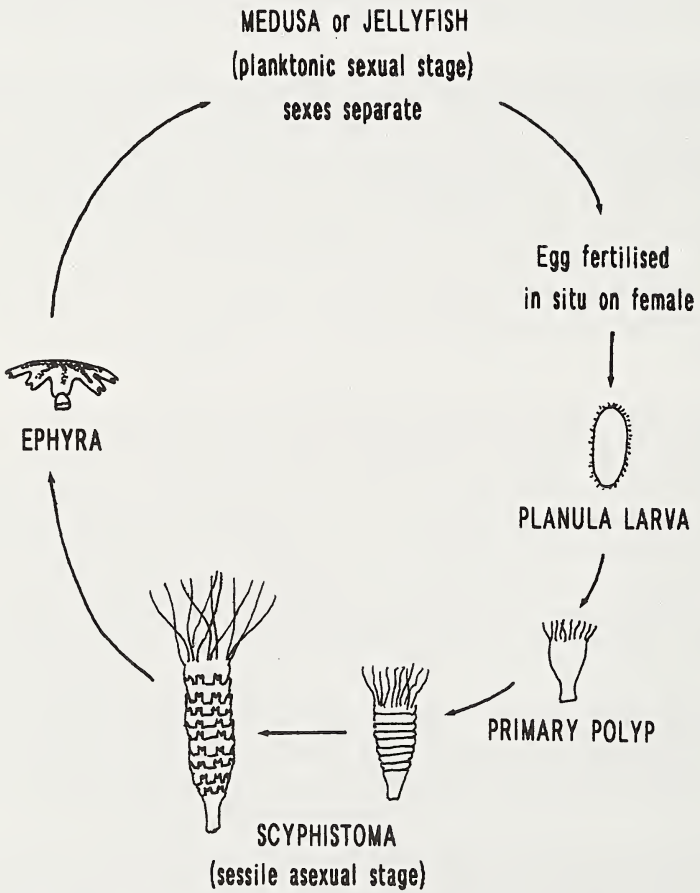

Fig. 1: Life-history of *Aurelia aurita*.

Methods

Weekly samples were taken over a two year period from March 1984 to March 1986 using a 0.5mm diameter plankton net of mesh size 287μm which was towed behind a dinghy in the same sample area as described in a previous report (Skinner, 1984). On each occasion two samples were taken at around high water, one sample being preserved immediately, the other taken home for examination live. Any ephyrae present in the latter were picked out, anaesthetised in an isotonic 7.5% solution of magnesium chloride, then fixed and preserved in 4-5% formalin.

All tows were horizontal, just below the surface. The total towing time on each occasion was about 23 min. and the total distance towed just under 1km.

Identifications were made with the aid of Russell (1970). Nomenclature is that of the Marine Biological Association (1957).

Results and discussion

The numbers of ephyrae caught per 15 min. haul per month are summarised in Fig.2. However, as ephyrae of different ages were caught, those which appeared to have been released recently (stage1 ephyrae) were segregated from the older stages and the numbers of each recorded (Table 1).

As ephyrae develop they pass through a number of distinctive stages before the characteristic form of the adult is reached. The three principal species pass through five such developmental stages, some examples of which are shown in Fig.3.

The contrast in numbers of stage 1 ephyrae caught during the investigation mean the peaks shown in Fig. 2 have different meanings. Thus about 68% of *Aurelia* ephyrae caught in March were stage 1 ephyrae, whereas about 69% of *Chrysaora* ephyrae caught in June and 76% of *Rhizostoma* ephyrae caught in July were stage 4 and 5 ephyrae. One month was very unusual: no ephyrae of *Chrysaora* were caught in June 1985. However, all jellyfish are liable to swarm as a result of wind, tide and wave movement and the failure to capture any *Chrysaora* ephyrae may be attributed to the consequent uneven distribution.

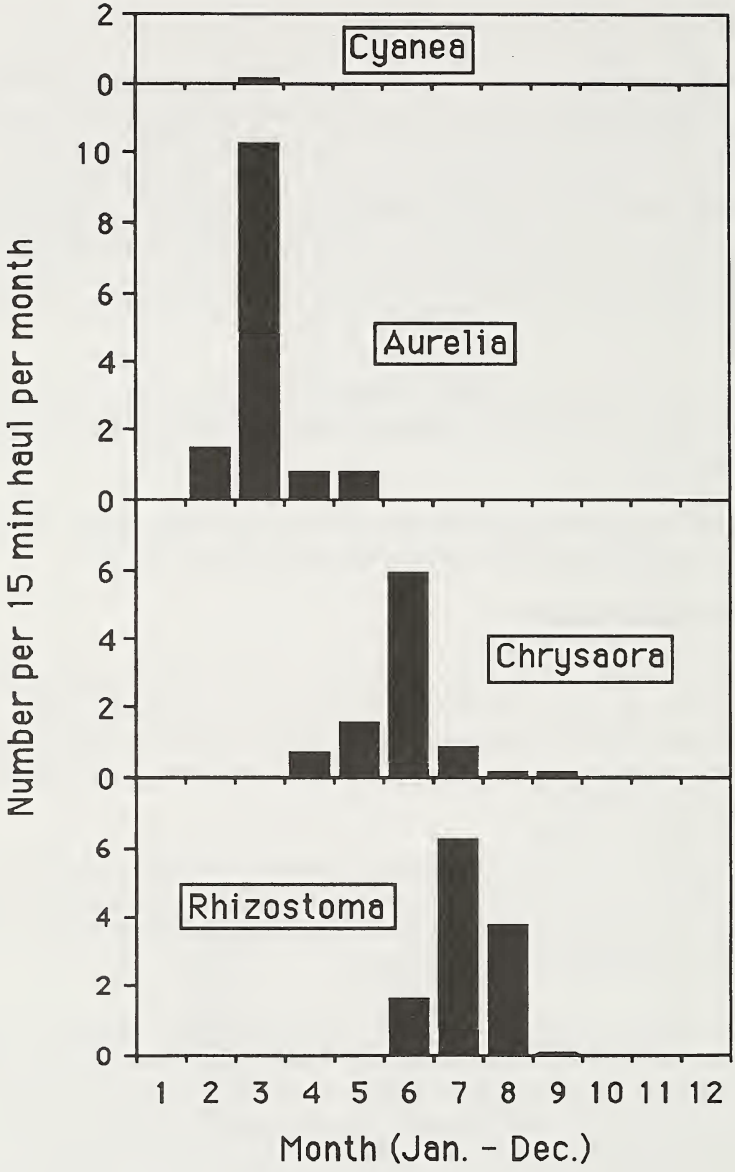

Fig. 2: Seasonal occurrence of ephyrae. Each value is the mean of four weekly samples taken each month from March 1984 to March 1986. Data from the same month in different years were pooled.

Interesting differences can be seen in the release of stage 1 ephyrae of the three main species. Those of *Aurelia* appear during two months only (February/March), but those of *Rhizostoma* and *Chrysaora* occur over a longer period: three months (June-August) for the former and six months (April-September) for the latter. Furthermore, the numbers of each species caught differ considerably, *Aurelia* stage 1 ephyrae being the most plentiful, those of *Chrysaora* and *Rhizostoma* less so (the latter much less) while none at all were taken of *Cyanea*. This suggests that the release of the three latter species takes place outwith the sampling area. Russell (1970) refers to the possibility that *Cyanea* scyphistomas live in deeper water in the Irish Sea. It seems likely that the scyphistomas of *Chrysaora* and *Rhizostoma* occur nearer, in the Solway Firth.

Some idea of the rate of growth of jellyfish under natural conditions may be obtained by comparing the size and date of capture of the largest adult or juvenile with the size and earliest date of capture of stage 1 ephyrae (Table 2). Although *Aurelia* ephyrae were known to be present in February 1984, the investigation proper did not start until March. The date of capture of the first stage 1 ephyrae is thus not known but has been taken to be the same as in 1985. *Rhizostoma* has been omitted as capture of the first stage 1 ephyrae was accompanied by older stages. The figures suggest a rapid rate of growth for both *Aurelia* and *Chrysaora*.

Table 1: Numbers of stage 1 Ephyrae and older stages. March 1984 to March 1986. Data from the same month in different years were pooled.

	Cyanea		*Aurelia*		*Chrysaora*		*Rhizostoma*	
	Stage 1 ephyrae	Older stages	Stage 1 ephyrae	Older stages	Stage 1 ephyrae	Older stages	Stage 1 ephyrae	Older stages
February	0	0	15	0	0	0	0	0
March	0	2	107	50	0	0	0	0
April	0	0	0	8	7	0	0	0
May	0	0	0	0	6	14	0	0
June	0	0	0	0	2	75	1	20
July	0	0	0	0	2	7	1	66
August	0	0	0	0	2	0	2	57
September	0	0	0	0	1	1	0	1

Table 2: Rate of growth of *Aurelia* and *Chrysaora*.

	Stage 1 ephyrae		Largest adult (A) or juvenile (J)		Estimated period of development (days)	Increase in size (approx.)
	Date of first capture	Mean live diameter (mm)	Date of capture	Diameter (mm)		
Aurelia	?	3.4*	14.6.84	200 (A)	114	x 59
	20.2.85	?	16.5.85	97 (A)	85	x 29
Chrysaora	17.4.84	2.9**	27.6.84	125 (J)	71	x 43
	15.4.85	?	1.7.85	60 (J)	77	x 21

* $n = 45$
** $n = 2$

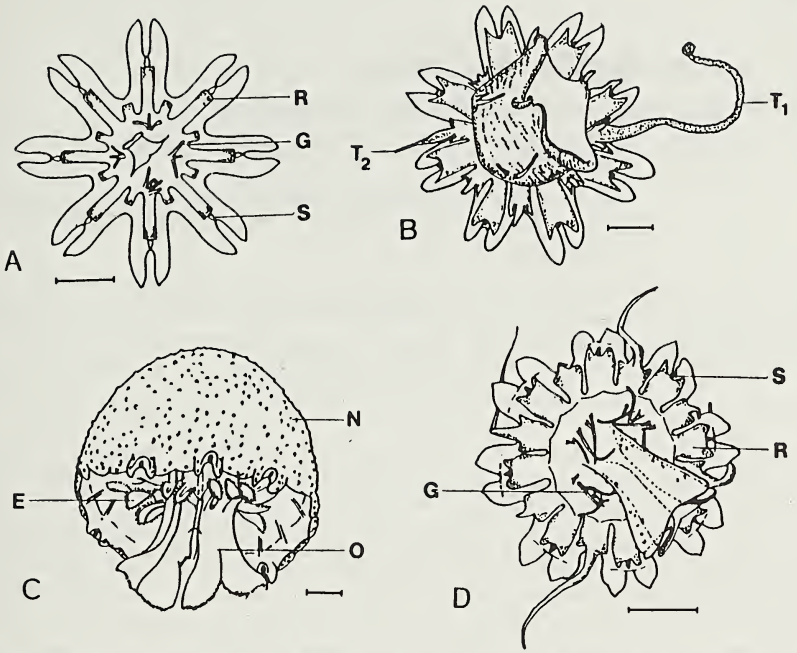

Fig. 3: Drawings of ephyrae at different developmental stages. A, *Aurelia aurita:* stage 1; B, *Cyanea capillata:* early stage; C, *Rhizostoma octopus:* stage 4 (no longer flat and disc-like, but still with one mouth opening; D, *Chrysaora hysoscella:* stage 3. E, epaulettes; G, gastric filaments; N. nematocyst warts; O, oral arms; R, radial canal; S, sense organ; T_1, first tentacle; T_2, second tentacle. All scale bars = 1 mm.

Finally it should be mentioned that many large fully grown specimens accompanied the arrival of *Rhizostoma* ephyrae in June. These must have developed from the previous year's production of ephyrae and then overwintered in deeper water. *Aurelia* and *Cyanea* also survive the winter in deeper water (Russell, 1970) but the appearance and size of the three adult *Aurelia* caught during the investigation indicated that they came from the February/March generation of the year of capture.

References

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